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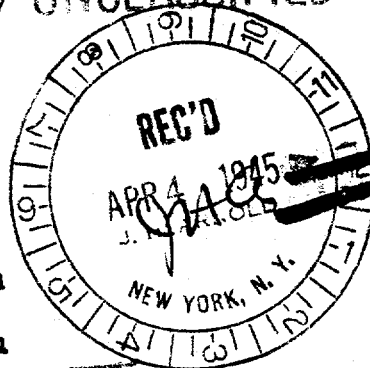
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REPORT NO.

KZ 3405

This document contains of 3 pages.
No 3 of 8

RR:2-a

March 30, 1945

Dr. R. Rosen

Ralph Landau

Admission of C-616 to C-216 Disposal Plant (K-1405)

On Sunday, March 11th, over 100 pounds of C-616 were pumped to the C-216 Disposal Plant (K-1405); subsequently, on Wednesday, March 14th, a somewhat smaller quantity (estimated at 15 lbs.) of C-616 was pumped to the Disposal Plant. A preliminary study of the circumstances surrounding these events has been made. It is likely that such occurrences may be encountered in the future, including the admission of enriched C-616 into the plant. These considerations lead to three questions:

1. How will the normal operation of the C-216 Disposal Plant be affected by C-616 intrusion?
2. What is the nature of the special hazards introduced by the admission of enriched C-616?
3. What steps can be taken to prevent passage of C-616 into the Disposal Plant?

It is the purpose of this memorandum to call attention to the problem, and to present a brief picture of possible steps to be taken. The subject has already been presented verbally to the people directly concerned, and further study is in progress.

REASONS FOR C-216 ADMISSION

On Friday, March 9th, a G-74 valve was inadvertently opened, and cells in the cascade (Buildings 302-3, 302-5, and part of 302-4) were pressured up with G-74, some nearly to atmospheric pressure, before the G-74 was cut off. Efforts were made to remove the G-74 using a small portable cold trap (in the absence of the regular cold trap equipment), but its capacity was too small to effect the desired purification. The portable C-616 disposal truck was then pressed into service, and used to capacity. This was not sufficient, and because of pressure from Carbide and Carbon, the decision was taken on Sunday, March 11th, to use the C-216 disposal pumps (Stokes) to remove G-74 and C-616 collecting at the light end of the cascade when operating for separation. Over 100 pounds of C-616 are estimated to have been pumped to the Disposal Plant. Obviously, this type of accident will likely not recur when cold traps are in service.

Carbide and Carbon Chemicals Corporation, Operating Contractor for the U.S. Atomic Energy Commission.

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Classification changed to: UNCLASSIFIED

Thomson W. Selby 4/15/96
 ABC of ABC (last review) 4/15/96

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 Date: 4/15/96
 Technical Information Officer
 Oak Ridge K-25 Site

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by authority of JD McLaugh Jr (K-25/LMES)
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(CG-PCD-4) 4/16/96

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JD McLaugh Jr
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4/17/96
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JD McLaugh Jr
(Document identification verified by)
4/17/96
(date)

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On Friday, March 8th, a G-74 valve was opened, and cells in the cascade (Building 302-3 part of 302-4) were pressurized up with G-74, some atmospheric pressure, before the G-74 was cut off. (In the absence of the regular cold trap equipment were made to remove the G-74 using a small portable cascade when operating for separation. Over 100 are estimated to have been pumped to the Disposal cascade when operating for separation. At the light to remove G-74 and C-616 collecting at the light of pressure from Carbide and Carbon, the decision and used to capacity. This too was not sufficient. The portable C-616 disposal truck was then pressed capacity was too small to effect the desired purging. The portable C-616 disposal truck was then pressed capacity was too small to effect the desired purging. The portable C-616 disposal truck was then pressed capacity was too small to effect the desired purging.

REASONS FOR C-216 ADMISSION

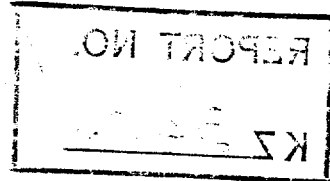
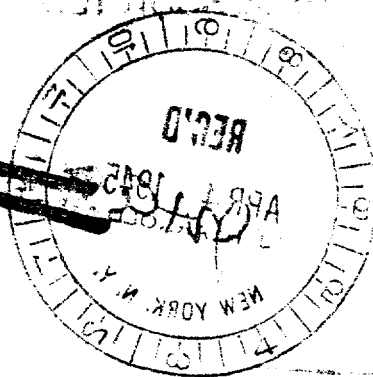
It is the purpose of this memorandum to call attention to the problem, and to present a brief picture of possible causes. The subject has already been presented to the people directly concerned, and further study:

1. How will the normal operation of the C-216 Disposal Plant be affected by C-616 intrusion?
2. What is the nature of the special hazards introduced by the admission of enriched C-616?
3. What steps can be taken to prevent passage of C-616 into the Disposal Plant?

On Sunday, March 11th, over 100 pounds of C-616 were pumped to the C-216 Disposal Plant (K-1405); subsequently, on Wednesday, March 14th, a somewhat smaller quantity (estimated at 15 lbs.) of C-616 was pumped to the Disposal Plant. A preliminary study of the circumstances surrounding these events has been made. It is likely that such occurrences may be encountered in the future, including the admission of enriched C-616 into the plant. These considerations lead to three questions:

Admission of C-616 to C-216 Disposal Plant (K-1405)

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Ralph Landau



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On Wednesday, March 14th, C-216 was inadvertently admitted to cells operating on C-616 from a cell being conditioned. Since it was not regarded as safe to bring C-216 into contact with carbon, (in the C-616 disposal truck), and in the absence of a cold trap, it was again decided to use the Stokes C-216 disposal pumps, and a quantity of C-616, roughly estimated at 15 lbs., was pumped to the C-216 Disposal Plant.

PHENOMENA AT THE DISPOSAL PLANT

The foregoing events were found out by the writer as a result of an investigation made to determine the cause of the brown coloration which appeared in the caustic solution used in the C-216 Disposal Plant on Sunday, March 11th. This brown color was quite strong, resembling iron, and appeared to be due to some soluble foreign material. No effect was noticed on the efficiency of operation of the plant.

CHEMISTRY OF REACTION

The literature indicates that C-616, on reaction with caustic solution, free of carbonate, should precipitate the yellow insoluble compound $\text{Na}_2\text{Ti}_2\text{O}_7$. Since lime is fed to the disposal system continuously, the calcium salt should perhaps be formed. The presence of carbonate favors the formation of a soluble complex ion; however, due to the lime feed, it is doubtful whether much carbonate was present in the Disposal Plant. Dr. Lafferty suggests that the simultaneous absorption of C-216 may have caused the formation of a soluble peroxy compound of T (this complex is known to have a brown color). Comparatively little information is at present available to Kellogg on the chemistry involved but steps have already been taken to obtain data available from Madison Square Area through Captain Rosenblum. However, the limited data available indicate that C-616 absorption by caustic, accompanied by lime feeding, may lead either to soluble or insoluble compounds, depending on the quantities involved and the conditions prevailing.

The formation of soluble salts may have the disadvantage of consuming caustic irreversibly (i.e., regeneration by lime is

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probably ineffective), and may lead to various hazards, including the undesirable possibility that soluble T compounds may get into the creek. Eventually, in any case, insoluble compounds will form, and might cause plugging of the tower, pumps, etc. It may accordingly be necessary to change the caustic solution more frequently than is currently practiced, or to modify the operation in other ways, at present not understood due to lack of detailed information regarding the chemistry involved.

FUTURE POSSIBILITIES

As the scope of plant operations increases, two sources of C-616 leak to the Disposal Plant appear probable in addition to the two types of leakages already described.

1. Partially plugged barriers will be reconditioned with C-216 after repairs of whatever kind, thereby generating C-616, which will be evacuated by the Stokes pumps to the Disposal Plant along with C-216, G-74 and HF.
2. Leakage of C-616 from operating cells into the C-216 disposal system may occur. There are a number of valves which may have C-216 (under vacuum) on one side, and C-616 on the other, and the C-616 may pass into the C-216 system either because of valve leakage, or accidental opening of the valve (the reverse of the second incident described). This situation can occur, by connection with the cell block valves, when a building or part of a building has been taken down for repairs, and one or more cells in it are being conditioned while other cells are being charged with C-616. There are other block valves around the cold trap piping for C-616 removal which may also encounter these conditions, when one cell is being treated with C-216 while another is being evacuated of C-616. In these cases, 4"

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G-17-AM valves are involved, which are to be pressured with G-74 when closed. If operators forget to turn the G-74 on, this type of leakage may involve significant quantities of C-616, since metal-seated valves may leak across the seats quite appreciably.

In the former case, the quantity of C-616 passing into the Disposal Plant is relatively small and it will slowly build up in the caustic system, with possible effects as described above. In the latter case, the quantity of C-616 going to the Disposal Plant may be rather large instantaneously, due to the high volumetric capacity of the Stokes pumps (200 cfm maximum). The undesirable effect on the operation of the Disposal Plant may be even more pronounced.

It is apparent that enriched C-616 may be involved in both sources of leaks. This poses the additional problems of special hazards and the value of the material lost. The matter of hazard has already been referred to Mr. Van Valkenburg verbally for further consideration. It is desired to ascertain the scope of the problem involved before a more detailed quantitative study is made. The question of value has not yet been considered.

POSSIBLE CORRECTIVE MEASURES

The first safety measure conceived was the installation of a special cold trap on the C-216 disposal line between Section 300 and the Disposal Plant. There are two objections:

1. Neglect of its operation as time goes on.
2. Special hazards that may be introduced by condensing HF with enriched C-616.

In connection with (1), it is likely that the cold trap might not be properly maintained if used very seldom. However, this cold trap could be placed near K-1405, and maintained by an entirely separate operating crew, who would not be psychologically affected by the comparative degree of use of other cold traps.

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In connection with (2), it is believed feasible to remove some of the HF by passage over a suitably designed sodium fluoride scrubber, probably capable of reducing the HF concentration to below 1%. The effect of HF, which will accumulate in the trap and must be removed periodically, on condensed and enriched C-616 has not yet received detailed study. It will also be necessary to prevent inleakage of moisture, so as to avoid formation of HF by hydrolysis. The design of such a cold trap system, in view of the large volume of inerts and low C-616 concentrations, may present complexities; no quantitative investigation has yet been made.

The use of a carbon trap is not practical or safe, because the carbon will react with C-216 to form explosive compounds (at temperatures below about 350°C, carbon reacts with C-216 to form FC, which explodes on heating above this temperature; at temperatures above 450°C, carbon burns smoothly in C-216 to form various fluorocarbons. Due to the intermittent nature of the operations, it is considered quite likely that explosions will occur.).

CONCLUSIONS

It is apparent that further study of the matters discussed above is required before a satisfactory solution is developed. As mentioned, steps have been initiated to obtain further preliminary information. In the meantime, Carbide has been advised by Mr. Gordon (at the operations meeting held on March 15th) that the C-216 Disposal System should not be used for C-616 evacuations, and Dr. Johnson has arranged to have Carbide analyze the caustic solution regularly, and watch its concentration, etc.

It is also imperative that operators be instructed always to pressure, with G-74, valves blocking off C-616 from C-216 evacuation lines.

RL:atr

Ralph Landau

cc	J. H. Arnold	F. L. Gordon
	L. H. Arnold	C. A. Johnson
	M. Benedict	R. E. Powers
	P. B. Gordon	K. Van Valkenburg